IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:

BRUNING et al.

Serial No.:   09/286,160

Filed: April 5, 1999

For: **APPARATUS AND METHOD FOR PROVIDING VERY LARGE VIRTUAL STORAGE VOLUMES USING REDUNDANT ARRAYS OF DISKS**

Art Unit: 2187

Examiner: Kimberly N. McLean-Mayo

Customer No. **22879**

Docket No. 200305027-1

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANT'S BRIEF UNDER 37 CFR 1.192

I. Real Party in Interest

> Hewlett-Packard Development Company, L.P.
> 20555 S.H. 249
> Houston, TX 77070
> USA

II. Related Appeals and Interferences

No other appeals or interferences are currently known to Appellant that will directly affect, be directly affected by, or have a bearing on the decision to be rendered by the Board of Patent Appeals and Interferences in the present appeal.

1

III. Status of Claims

Claims 1-8 and 10-20 are pending in the application. Original claim 9 was cancelled. No claims have been allowed. Claims 1-2, 4-8, 11-16, and 18-20 stand rejected under 35 U.S.C. §103 as being unpatentable over Massiglia, The RAID Book, in view of U.S. Patent No. 5,991,844 to Khosrowpour. Claims 3 and 17 stand rejected under 35 U.S.C. §103 as being unpatentable over Massiglia and Khosrowpour further in view of U.S. Patent No. 6,330,687 to Griffith. Claim 10 stands rejected under 35 U.S.C. §103 as being unpatentable over Massiglia and Khosrowpour further in view of U.S. Patent No. 6,282,610 to Bergsten and U.S. Patent No. 6,256,748 to Pinson. On July 8, 2003, Appellants appealed from the final rejection by filing a Notice of Appeal of all pending claims 1-8 and 10-20.

IV. Status of Amendments

In response to the Final Office Action mailed March 11, 2003, Appellants provided in an Amendment and Response dated May 12, 2003 remarks that addressed the rejections under 35 U.S.C. § 103 and did not further amend the claims. In an Advisory Action mailed June 12, 2003, it was indicated that the request for reconsideration was considered and that the arguments were not found to be persuasive. However, the Response to Arguments in the Advisory Action did not address Applicants' arguments that at least one element of each of the independent claims was not shown in the combination of references.

All claim amendments have been entered, and Claims 1-8 and 10-20, as originally filed or as previously amended, remain in the application for consideration in this appeal.

V. Summary of the Invention

Briefly, the invention is directed toward an apparatus and method for providing a virtual volume. With reference to Figure 2, a very large volume 10 is connected to a local host computer 20 by a local front-end controller 22 "that acts as a mirroring and striping engine" (see Applicants' specification at page 5, beginning at line 11). The controller 22 "forms the mirror sets M1-M11 (see Figures 1A and 1B) and then stripes them so as to present them to the local host computer 20 as the very large volume 10" (see Applicants' specification at page 5, lines 14-16).

The volume 10 includes a plurality of back-end controllers 26, 36, 38, 40, and 42 that "act as RAID-5 engines by forming the disks 28, 30, 32, and 34" into RAID-5 sets and "presenting these sets to front-end controller 22 as members" (see Applicants' specification at page 5, lines 17-26). Physical disks 28, 30, 32, and 34 provide redundant local storage, clone storage, primary remote storage, and redundant remote storage.

As discussed in Applicants' specification beginning at page 4, line 24 with reference to Figures 1A, 1B, and 2, a RAID-5 set PL1 includes a plurality of physical disks 12 distributed across a similar number of SCSI busses, bus1-bus6, of a back-end controller (such as back-end controller 26). The other RAID-5 sets are configured similarly as shown in Figures 1A and 1B. Additionally, a plurality of "spare physical disks 16" are provided "to seamlessly replace any failing disks" on any of the busses, bus1-bus6, by "rebuilding the data stored on failing disks from parity data, thereby restoring redundancy after a disk failure. An example of how such an arrangement of a volume 10 provides enhanced redundancy is explained in Applicants' specification in the paragraph beginning at line 31 of page 4.

To further explain the invention, as stated in the Summary of the Invention at page 2, lines 5-22:

"An inventive apparatus for providing a very large storage volume includes a plurality of disks and a local back-end controller that organizes and presents the disks as redundant arrays of disks (*e.g.*, RAID-5 sets). Also, a local front-end controller stripes the redundant arrays of disks and presents the striped arrays as a very large storage volume.

To provide local redundancy, another plurality of disks and an associated back-end controller can be provided, in which case the local front-end controller forms mirror sets from the redundant arrays of disks presented by both back-end controllers. In addition, a further plurality of disks and an associated back-end controller can be provided to enable off-line backup of the data stored on the volume by cloning the data onto the disks, and then using the disks as the data source for off-line backup. Also, a still further plurality of disks and an associated back-end controller can be provided at a remote location to protect against disasters occurring at the primary location (commonly referred to as "disaster tolerance"). The disks and back-end controllers providing cloning capabilities and disaster tolerance can be incorporated into the mirror sets formed by the local front-end controller. Further, spare disks can be provided on any or all of the back-end controllers to allow restoration of redundancy after the loss of any particular disk."

VI. Issues

1. Whether claims 1-2, 4-8, 11-16, and 18-20 are unpatentable under 35 U.S.C. §103(a) over Massiglia (The RAID Book) in view of Khosrowpour (U.S. Patent No. 5,991,844).

2. Whether claims 3 and 17 are unpatentable under 35 U.S.C. §103(a) over Massiglia and Khosrowpour further in view of Griffith (U.S. Patent No. 6,330,687).

3.   Whether claim 10 is unpatentable under 35 U.S.C. §103(a) further in view of Bergsten (U.S. Patent No. 6,282,610) and Pinson (U.S. Patent No. 6,256,748).

VII. Grouping of Claims

The following groups of claims do not stand or fall together.

Rejection under 103(a):

Group I:	claim 1-2, 4-8, 11-16, and 18-20
Group II:	claim 3 and 17; and
Group III:	claim 10.

VIII. Argument

A. Rejection of Claims 1-2, 4-8, 11-16, and 18-20 under 103(a) based on Massiglia in View of Khosrowpour is Improper

Independent claim 1 calls for an apparatus for providing a virtual volume that, among other things, includes "a plurality of back-end controllers" coupled to a plurality of disks for organizing and presenting the first plurality of disks as a third plurality of redundant arrays. Further, "a front-end controller" is provided that is coupled to the plurality of back-end controllers "for generating mirror sets" from at least one of the disks in the redundant arrays received from the plurality of back-end controllers. Claim 1 further calls for the front-end controller to perform "striping at least one of the disks in the third plurality of redundant arrays of disks and presenting the striped arrays as a virtual volume." The claimed combination of back-end controllers and a front-end controller and their required functionalities are not shown or suggested by Massiglia or Khosrowpour taken separately or in combination. Accordingly, Appellants request that the rejection of claim 1 under 35 U.S.C. § 103(a) over Massiglia in view Khosrowpour be withdrawn.

The March 11, 2003 Office Action states in the first paragraph of Section 3 that Massiglia teaches a plurality of back-end controllers coupled to the plurality of

disks for organizing and presenting the disks as a redundant array of disks and also teaches a front-end controller coupled to the back-end controllers for striping the plurality of redundant arrays of disks and presenting the striped array as a virtual volume. Massiglia is asserted to teach these limitations of claim 1 in Figures 73 and 74 and at pages 151 and 153 with its description of the lower and upper array management functions, with the lower array management functions corresponding to the back-end controllers of claim 1 and the upper array management functions corresponding to the front-end controller of claim 1.

The Office Action then states that "Massiglia does not explicitly disclose the front-end controller generating mirror sets" as called for in claim 1, and states that "Khosrowpour teaches the concept of controller (Figure 2, Reference 140), generating mirror RAID sets and striping RAID sets (C 5 L 31-35)." Note, that Khosrowpour states at col. 5, lines 31-36 that the "RAID controller 140 implements data mirroring and striping according to one or more RAID levels as described" in an earlier edition of the Massiglia reference. So, it is unclear what additional teaching is provided by Khosrowpour.

The Office Action does not, however, argue that the combination teaches each and every element of claim 1, i.e., the Office Action does not argue that with this teaching of Khosrowpour overcomes or makes up for the admitted deficiency in Massiglia. Instead, the Office Action argues that it "would have been obvious to one of ordinary skill in the art at the time of the invention was made to also generate mirror sets from the RAID set using the front end controller in Massiglia's system for the desirable purposes of improved reliability and flexibility." In other words, the combination of the references is admitted in the Office Action to fail to result in the claimed apparatus of claim 1 and to achieve the invention further modifications are required. Applicants do not agree that such additional modification of these

combined references would be obvious to one skilled in the art, and hence, claim 1 is believed allowable over Massiglia in view of Khosrowpour.

Further, the Office Action does not provide a proper motivation for combining these two references or for further modifying the teachings of the two references to achieve the apparatus of claim 1. The Office Action rejected a prior argument made in a Response filed January 9, 2003 that Massiglia teaches away from combining striping and mirroring into a single controller. However, in a recent case the Federal Circuit indicated that if references taken in combination would produce a seemingly inoperative device, such references teach away from the combination. McGinley v. Franklin Sports Inc., 262 F.3d 1339, 60 USPQ2d 1001 (Fed. Cir. 2001). In the present case, the proposed combination of the Massiglia and Khosrowpour teachings would be inoperable. Massiglia teaches a single controller that performs multiple types of RAID protection on a single array of physical disks. The Khosrowpour teaches the use of redundant RAID controllers to maintain data transfers in the event of a fault.

The combination of Massiglia and Khosrowpour suggested by the Office Action is presumed to be achieved by using the dual RAID controllers 140 and 200 to implement each of the layers in Massiglia (but, this is not clear from the explanation provided in the Office Action). However, each of the management layers in Massiglia performs different RAID functions and mappings. In contrast, the Khosrowpour controllers 140, 200 are essentially and necessarily identical in function and performance. Hence, if one were to combine these two references, the functionality provided by the front-end controller and back-end controllers of claim 1 would not be suggested. Alternatively, if the Khosrowpour controllers 140, 200 were combined consistent with Massiglia, this combination would fail to provide the redundant, failover function taught as desirable by Khosrowpour. Accordingly, the references teach against combination because the combination would be inoperable.

As noted above, the only motivation provided for then modifying the inoperable combination is for "the desirable purpose of improved reliability and flexibility." However, this motivation appears to be merely impermissible 20/20 hindsight, as the only motivation seems to be coming from Applicants' own specification. Because there is a lack of motivation to combine the references or to modify the references as called for in the Office Action, the rejection of claim 1 should be withdrawn.

Further, the Khosrowpour controllers 140, 200 are redundant with respect to each other, which means that each controller performs the same functions, and each controller has the same connections to the physical storage disks. If the two controllers 140, 200 were connected differently or were to provide different functions, the essential purpose of the Khosrowpour patent would be destroyed. Each of the controllers 140, 200 is coupled to the physical disks...not to a virtual disk. In other words, there is no suggestion to alter the Khosrowpour design so that one of the controllers was coupled to the other so as to provide a RAID mapping of the drives presented by the first controller. Again, such a combination violates the very essence of the Khosrowpour design. For this additional reason, claim 1 is not shown or suggested by the Khosrowpour.

Claims 2 and 4-5 depend from claim 1 and are believed to be allowable for at least the same reasons for allowing claim 1. Additionally, claim 2 is separately allowable because it calls for the plurality of disks to include spare disks. Massiglia does not show spare disks. The Office Action states that a mirror arrangement inherently consists of a one active disk and one spare disk. However, in a mirrored arrangement, both of the mirrors are considered active. A "spare" as called for in claim 2 is a disk that is available to be substituted in place of a failed one of the mirrors, not one of the mirrors itself. Claim 4 calls for the back-end controllers to comprise a RAID engine that presents the disks as a plurality of RAID sets. The Office Action (and prior communications) have not indicated where the limitations of

claim 4 are taught in the references. Instead, the Office Action merely states "a RAID engine," but this limitation is not shown in Massiglia in Figures 73 or 74 as cited by the Office Action. Claim 5 calls for the RAID engine to present the plurality of disks as RAID-5 sets, and the Office Action states at page 3, the fourth line from the bottom, that "Massiglia does not explicitly disclose the RAID engine as a RAID 5 engine" but then implies a mere discussion of a RAID 5 is adequate for suggesting this specific limitation. Applicants disagree and believe claim 5 is not obvious in light of Massiglia taken alone or in combination with Khosrowpour and is also separately patentable over claim 1.

Independent claim 6 calls for, among other things, a RAID engine comprising a plurality of back-end controllers coupled to a plurality of disks that present the plurality of disks as a plurality of RAID sets. Claim 6 also calls for a striping engine coupled to the RAID engine for generating mirror sets from at least one of the plurality of RAID sets, striping at least one of the disks in the member RAID sets, and presenting the striped member RAID sets as a virtual volume. Claim 6, therefore, distinguishes over the relied on combination of references for at least the reasons set out in regard to claim 1. Specifically, the combination of Massiglia and Khosrowpour reference does not show the combination of front-end and back-end controllers each coupled to each other and to physical storage devices so as to perform the specific RAID functions and mappings called for in claim 6. Claim 7 is allowable for at least the same reasons as claim 6 and, additionally, for the reasons for allowing dependent claim 5.

Independent claim 8 calls for, among other things, back-end controllers, each configured to organize and present X N-member RAID sets, and each having N busses capable of supporting X+1 disks each. Claim 8 further calls for a second plurality of groups of X+1 disks, wherein each disk in the group is coupled to one of the N busses associated with one of the plurality of back-end controller busses, and a

front-end controller coupled to the plurality of back-end controllers for receiving the X N-member RAID sets as members, striping the X N-member RAID sets, and presenting the striped X N-member RAID sets as a virtual volume. These features of the apparatus called for in claim 8 are not shown or suggested in the relied on references.

The Office Action at page 4 again cites Massiglia at Figure 73 for teaching the features of the claimed apparatus, but it is not clear from this block drawing that Massiglia teaches groups of disks grouped together and coupled to one of the N busses associated with the back-end controller busses as called for in claim 8. The Office Action reads too much into the simplified arrows of these figures and infers, somehow, that these simplified arrows teach the specific recitations of claim 8. Further, as discussed relative to claim 1, the combination of Massiglia and Khosrowpour fails to teach "wherein the local front-end controller is configured to generate mirror sets." Such a deficiency is admitted in the Office Action, but it is asserted that it would have been obvious to modify the combined teaching to the two references to achieve the invention as claimed in claim 8. Again, Applicants disagree that such modification would be readily apparent or that there is any motivation to combine the references let alone to modify such an inoperable combination.

Further, Massiglia does not show multiple controllers that are interconnected so that the virtual disks presented by one controller become members of a RAID set managed by another controller. Khosrowpour does not teach the interconnection and functionality called for in claim 8, and particularly, does not provide such teaching at the citation provide in the Office Action of Figure 2, Reference 140. Moreover, as noted above, the combination of Massiglia and Khosrowpour does not result in the claimed two-controller apparatus of claim 8. For at least these reasons and the reasons stated above in reference to claim 1, claim 8 are believed to be allowable.

10

Claims 11 and 12 depend from claim 8 and are believed allowable at least for the reasons for allowing claim 8. Additionally, claim 11 calls for "a remote front-end controller coupled to at least some of the plurality of the back-end controllers" and carrying out several functions similar to the front-end controller including striping the member RAID sets and presenting the striped mirror sets as the virtual volume. Claim 12 further calls for the remote front-end controller is configured to generate mirror sets. Neither Massiglia nor Khosrowpour teach or suggest these limitations. The Office Action in the first full paragraph of page 5 acknowledges the deficiency in Massiglia but then takes Official Notice that redundant controllers are well known and then stated that is obvious to have added a redundant controller at a remote location and to have it perform the same functions as the front end controller.

Applicants traverse the use of Official Notice to finding the limitations of Claims 11 and 12. The Examiner first took Official Notice of these limitations in the Office Action mailed January 10, 2002, and Applicants traversed this in the Response mailed August 26, 2002. The Examiner has taken the stance that since the taking of Official Notice was not asserted immediately in the next response that Applicants have waived their rights to ever argue whether this limitation was known in the arts and such a limitation is admitted as known. While it is acknowledged that the Office has a procedural need to be aware of a challenge to the taking of official notice in a timely fashion, the challenge to the taking of official notice was made in response to the first office action received after filing a request for continuing examination. The rationale stated in the MPEP is that an examiner must be given the opportunity to provide the evidence or explain why no evidence is required. It would appear that the Examiner in this case has had such an opportunity as several communications were transmitted from the Office since the traversal was submitted. Accordingly, the challenge to the taking of Official Action is restated herein, and, for the purpose of a complete record, Applicants do not assent to the determination that the facts which are supported only by Official Notice are admitted prior art.

Independent claims 13, 14, and 18 call for, in varying language, the combination of elements including back-end controllers that are coupled to front-end controllers where the back-end and front-end controllers provide distinct RAID functionality. As set out above with reference to claim 1, the combined reference fail to show or suggest either the interconnection called for in these claims or the functionality achieved. Claims 15 and 16 depend from claim 14 and are believed allowable for the reasons for allowing claim 14. Further, as discussed with relation to claims 4 and 5, these claims are believed separately patentable over claim 14 and are believed allowable for the reasons for allowing claims 4 and 5. Claims 19 and 20 depend from claim 18 and are believed allowable for the reasons for allowing claim 18. Additionally, claims 19 and 20 include limitations similar to claims 4 and 5 and are believed allowable for the additional reasons provided for allowing these claims.

B. **Rejection of Claims 3 and 17 under 103(a) based on Massiglia and Khosrowpour in View of Griffith is Improper**

Claims 3 and 17 depend from independent claims 1 and 14, respectively. These claims are believed allowable, and claims 3 and 17 are believed allowable as depending from an allowable base claim. Additionally, Griffith does not overcome the deficiencies of Massiglia and Khosrowpour, and specifically, Griffith fails to teach front and back-end controllers as called for in claims 1 and 14. With reference to Figure 1, Griffith does not teach a front-end controller that generates mirror sets. For these reasons and the additional reasons provided for claims 1 and 14, claims 3 and 17 are not taught or even suggested by Massiglia and Khosrowpour in view of Griffith, and this rejection should be withdrawn as being improper.
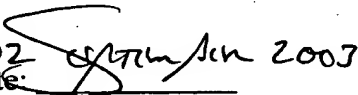
C. **Rejection of Claim 10 under 103(a) based on Massiglia and Khosrowpour in View of Bergsten and Pinson is Improper**

Claim 10 depends from independent claim 8 and is believed allowable as depending from an allowable base claim. Further, the reasons provided for allowing claim 8 are applicable to claim 10 because Bergsten and Pinson do not overcome the

deficiencies of Massiglia and Khosrowpour. Neither Bergsten nor Pinson teach the combination of a front and back-end controllers as called for in claim 8. Claim 10 further calls for the back-end controllers to include primary local, redundant local, cloning, primary remote, and redundant remote back-end controllers. While Bergsten and Pinson may discuss controllers that provide similar functioning, these references do not teach that such controllers should be combined as called for in claim 10, and the Office Action provides no specific motivation to include these particular back-end controllers in any of the references but merely states that it would be "desirable for the purpose of increased reliability." Again, the motivation appears to provided by Applicants' description of the claimed invention and not from the references or knowledge of one skilled in the art. For these additional reasons, the rejection of claim 10 based on the combination of references is improper.

Conclusion

In view of all of the above claims 1-8 and 10-20 are believed to be allowable and the case in condition for allowance and it is respectfully requested that the Examiner's rejections be overturned.

Respectfully submitted,

Date: 02 September 2003

BY:

William J. Kubida, Reg. 29,664
HOGAN & HARTSON LLP
Phone: (719) 448-5909
Fax: (303) 899-7333

IX. APPENDIX OF CLAIMS ON APPEAL

1.   An apparatus for providing a virtual volume, the apparatus comprising:

a first plurality of disks;

a second plurality of back-end controllers coupled to the first plurality of disks for organizing and presenting the first plurality of disks as a third plurality of redundant arrays of disks; and

a front-end controller coupled to the second plurality of back-end controllers for generating mirror sets from at least one of the disks in a third plurality of redundant arrays of disks received from the second plurality of back-end controllers, striping at least one of the disks in the third plurality of redundant arrays of disks and presenting the striped arrays as a virtual volume.

2.   The apparatus of claim 1 wherein the plurality of disks includes one or more spare disks.

3.   The apparatus of claim 1 wherein the plurality of back-end controllers each include a plurality of busses, each coupled to one and only one of the disks associated with each of the plurality of redundant arrays of disks.

4.   The apparatus of claim 1 wherein the plurality of back-end controllers comprises a RAID engine for presenting the plurality of disks as a plurality of RAID sets.

5.   The apparatus of claim 4 wherein the RAID engine comprises a RAID engine for presenting the plurality of disks as a plurality of RAID-5 sets.

6.   An apparatus for providing a virtual volume, the apparatus comprising:

a first plurality of disks;

a redundant array of independent disks (RAID) engine comprising a second plurality of back-end controllers coupled to the first plurality of disks for organizing and presenting the first plurality of disks as a third plurality of RAID sets; and

a striping engine coupled to the RAID engine for receiving the third plurality of RAID sets as members, generating mirror sets from at least one of the disks in the

third plurality of RAID sets from the second plurality of back-end controllers, striping at least one of the disks in the member RAID sets, and presenting the striped member RAID sets as a virtual volume.

7. The apparatus of claim 6 wherein the RAID engine comprises a RAID-5 engine.

8. An apparatus for providing a virtual volume, the apparatus comprising:

a first plurality of back-end controllers, each configured to organize and present X N-member RAID sets, and each having N busses capable of supporting X+1 disks each;

a second plurality of groups of X+1 disks, wherein each disk in the group is coupled to one of the N busses associated with one of the plurality of back-end controller busses; and

a local front-end controller coupled to the plurality of back-end controllers for receiving the X N-member RAID sets as members, striping the X N-member RAID sets, and presenting the striped X N-member RAID sets as a virtual volume,

wherein the local front-end controller is configured to generate mirror sets from the RAID sets received as members from different back-end controllers, to stripe the mirror sets, and to present the striped mirror sets as the virtual volume.

9. (cancelled)

10. The apparatus of claim 8 wherein the plurality of back-end controllers includes primary local, redundant local, cloning, primary remote, and redundant remote back-end controllers.

11. The apparatus of claim 8 further comprising a remote front-end controller coupled to at least some of the plurality of the back-end controllers for receiving RAID sets as members, striping the member RAID sets, and presenting the striped member RAID sets as the virtual volume.

12. The apparatus of claim 11 wherein the remote front-end controller is configured to generate mirror sets from the received RAID sets, to stripe the mirror sets, and to present the striped mirror sets as the virtual volume.

13. An electronic system comprising:

a computer; and

an apparatus coupled to the computer for presenting a virtual volume to the computer, the apparatus including:

a first plurality of disks;

a second plurality of back-end controllers coupled to the first plurality of disks for organizing and presenting the first plurality of disks as a third plurality of redundant arrays of disks; and

a front-end controller coupled to the second plurality of back-end controllers for generating mirror sets from at least one of the disks in the plurality of redundant arrays of disks, and striping the third plurality of redundant arrays of disks and presenting the striped redundant arrays of disks as the virtual volume.

14. A method of storing data on a first plurality of disks, the method comprising:

using a second plurality of back-end controllers, organizing the first plurality of disks into a second plurality of redundant arrays of disks;

using at least one front-end controller, generating mirror sets from at least one of the disks in the second plurality of redundant arrays of disks, striping at least one of the second plurality of redundant arrays of disks together to form a virtual volume; and

writing the data to the virtual volume.

15. The method of claim 14 wherein organizing the plurality of disks comprises organizing the plurality of disks into a plurality of RAID sets.

16. The method of claim 15 wherein organizing the plurality of disks comprises organizing the plurality of disks into a plurality of RAID-5 sets.

17. The method of claim 14 wherein organizing the plurality of disks includes:

providing one or more back-end controllers, each having a plurality of busses; and

coupling the plurality of disks to the one or more back-end controller busses so that each bus is coupled to no more than one disk from each of the plurality of redundant arrays of disks and each bus is coupled to a spare disk.

18. A method of storing data on a plurality of disks, the method comprising:

using a plurality of back-end controllers, organizing the plurality of disks into a plurality of redundant arrays of disks;

using at least one front-end controller, forming mirror sets from the plurality of redundant arrays of disks;

using at least one front-end controller, striping the mirror sets together to form a virtual volume; and

writing the data to the virtual volume.

19. The method of claim 18 wherein organizing the plurality of disks comprises organizing the plurality of disks into a plurality of RAID sets.

20. The method of claim 19 wherein organizing the plurality of disks comprises organizing the plurality of disks into a plurality of RAID-5 sets.